Montana Fish, Wildlife & Parks

2300 Lake Elmo Drive
Billings MT 59105

July 8, 2015

DECISION NOTICE

TO: Environmental Quality Council*
Director's Office, Dept. of Environmental Quality*
Montana Fish, Wildlife & Parks*

Director's Office	Lands Section
Parks Division	Design & Construction
Fisheries Division	Legal Unit
Wildlife Division	Regional Supervisors

Tim Baker, Governor's Office*
Judy Beck, Press Agent, Governor's Office*
Montana Historical Society, State Preservation Office*
Janet Ellis, Montana Audubon Council*
Montana Wildlife Federation*
Montana State Library*
George Ochenski
Montana Environmental Information Center*
Wayne Hirst, Montana State Parks Foundation*
FWP Commissioner Matt Tourtlotte*
Montana Parks Association/Our Montana (land acquisition projects)
Matt Wolcott, DNRC Area Manager, Southern Land Office*
Park County Commissioners*
Marcia Woolman*
Jason Burkhardt*
Clint Sestrich*
Todd Koel*
Other Local Interested People or Groups
* (Sent electronically)

Ladies and Gentlemen:
A draft Environmental Assessment (EA) was prepared for the proposed removal of nonnative eastern brook trout and hybridized Yellowstone cutthroat trout from the Soda Butte Creek Drainage near Cook City Montana to protect the Lamar River Drainage in Yellowstone National Park from invasion by these species. This is a joint project involving Montana Fish, Wildlife and

Parks (FWP), Wyoming Game and Fish, the Shoshone and Gallatin/Custer National Forests, and Yellowstone National Park. It was proposed to use chemical treatment to remove the existing fish population from Soda Butte Creek and then restock with Yellowstone cutthroat trout from the best available source.

This EA was released for a 30 day comment period on May 14, 2015. Due to early issues with being able to view the EA on the FWP web page and the initial publication date in a weekly newspaper in Wyoming, the comment period was extended until June 19, 2015. The draft EA was circulated to interested agencies, groups and persons, and legal notices and a news release were sent to local newspapers in MT and WY, and postcards were sent to landowners along Soda Butte Creek to inform them of the project and to solicit their feedback on the proposed effort. The EA was also posted on FWP's website. Two public meetings to discuss this project were held in Livingston on May 18th and in Cooke City on May 27th. Five members of the public attended these two meetings to ask questions and learn more about the project. Oral comments were not taken at these meetings. A total of 44 comments were received during the open comment period. One additional comment was received within several days after the identified comment period, but was accepted as an official comment.

Of the written comments received, 2 were general comments, 24 were classified as *opposed* to the proposal, while 18 are classified as *supportive* of the proposal. *Supportive* comments included those from Montana Trout Unlimited, the Magic City Fly Fishers, Trout Unlimited Chapter 582, and Beartooth Alliance.
Multiple commenters were concerned or opposed to removal of the slightly hybridized Soda Butte Creek Yellowstone cutthroat trout population and/or reestablishment of Soda Butte Creek Yellowstone cutthroat trout in timely order to decrease duration of lack of angling opportunity. Additional concern was received requesting more specificity of best available source used for reintroduction. In addition, several opposed commenters focused on the issue of rotenone use. More specific issues (36) were raised by commenters, which are attached as well as FWP's responses to those comments.

Decision

After carefully reviewing this proposal and corresponding comments, and with sensitivity to acceptable time required to reestablish Yellowstone cutthroat trout in Soda Butte Creek, it is my decision to proceed with the proposed action to use rotenone to remove brook trout from the Soda Butte Creek drainage but modify it to include the salvage and use of the existing slightly hybridized (less than 0.7%), Yellowstone cutthroat trout to restock the creek after treatment. FWP determined after carefully considering the attached comments, FWP's desire to reestablishing a fishery in Soda Butte Creek as quickly as possible to restore angling opportunities, and based on preliminary data from potential off-site sources of Yellowstone cutthroat, the "best available source" identified to repopulate Soda Butte Creek is the current, slightly hybridized, Yellowstone cutthroat trout population in Soda Butte Creek. Thus, my decision is to use electrofishing to capture as many of the Yellowstone cutthroat trout from Soda Butte Creek as possible prior to the chemical treatment. These salvaged fish will be held outside of the treatment area, but within treatment drainage (either in tributaries that won't be treated or in hatchery tanks) and reintroduced following completion of the first treatment. Supplemental stocking may occur in years following the treatment from outside sources to enhance the genetics of the Yellowstone cutthroat population in Soda Butte Creek. Further investigation is required to solidify the best available off-site sources of Yellowstone cutthroat and to determine if supplemental stocking is warranted. If you have questions regarding this decision notice or wish a copy of the final EA, you may contact Jason Rhoten at jrhoten@mt.gov (328-6160) or Ken Frazer at kfrazer@mt.gov (247-2961).

Sincerely,

Bob Gibson,
Acting Regional Supervisor
bgibson@mt.gov

Issue 1. The use of the piscicide rotenone including topics related impacts on mammals, birds, and aquatic organisms; and current necessity for its use.

Background Information: As described in the EA, rotenone is a naturally occurring substance derived from the roots of tropical plants found in Australia, Oceania, southern Asia, and South America. Rotenone has been used by native people for centuries to capture fish for food in areas where these plants are naturally found. It has been used in fisheries management in North America since the 1930s. Rotenone powder was previously registered for use as a natural insecticide for gardening and to control parasites such as lice on domestic livestock. Currently, several liquid and powder formulations of rotenone are Environmental Protection Agency (EPA) registered products for the removal of unwanted fish.

FWP has a long history of using rotenone to manage fish populations in Montana that span as far back as 1948. The department has administered rotenone projects for a variety of reasons, but principally to improve angling quality or for native fish conservation. Rotenone acts by inhibiting electron transfer at the cellular level. It is especially effective at low concentrations (< 1 part per million) with fish because it is readily absorbed into the bloodstream through the thin cell layer of the gills. Mammals, birds and other non-gill breathing organisms do not have this rapid absorption route into the bloodstream, and thus can tolerate exposure to concentrations much higher than that used to kill fish. Gill breathing amphibians can be impacted by rotenone; however, this can be mitigated by implementing treatments when larvae have metamorphosed into air-breathing adults (as proposed in this project). Aquatic invertebrates are impacted by rotenone, though studies have shown they rapidly re-colonize treated stream reaches.

Rotenone in the proposed project would be primarily applied to the stream with the use of drip stations that disperse a precise amount of diluted rotenone. Backpack sprayers would be used to help apply rotenone to areas of slow moving water. Potassium permanganate would be applied to the stream at the lower bounds of the projects to detoxify rotenone within a short distance (< 0.5 miles), thereby preventing impacts to lower reaches of the streams, and downstream waters. Neutralizing rotenone is discussed in more detail in the Response to Issue 9 below.

> ***Response:*** Some commentors believe the treatment will "sterilize" the stream or ecosystem. As clearly stated and documented throughout the EA and in public correspondence regarding the project, this will not happen. The EA presents an exhaustive review of the scientific literature that addresses the short-term and long-term effects of rotenone refutes the “sterilization” concern. Some aquatic invertebrates have shown short-term decreases in density after fish eradication treatments, but have recovered to pre-treatment densities within 1 year after treatment. In most cases, reduced invertebrate densities were a result of exposure to higher concentrations of toxicants than will be used in this project. As documented in the EA, plants, adult amphibians, reptiles, birds, and mammals are not affected by the concentrations of rotenone that will be applied during this project. Additionally, few, if any, non-target organisms, such as amphibians, will be in life stages sensitive to rotenone during the application period in August. Evaluations of mammals' potential exposure to rotenone from scavenging indicate that acute toxicity from ingesting rotenone-killed fish is highly unlikely (EPA 2007). In general, ingested rotenone does not affect mammals because of digestive action in their stomach and

intestines (AFS 2002) (also see Response to Issue 20). Birds may also scavenge dead fish and invertebrates or ingest treated water; however, research on toxicity of rotenone to birds indicates that acute toxicity was not possible from field application of rotenone to achieve a fish kill. In general, birds require concentrations of rotenone at least 1,000 to 10,000 times greater than is required for lethality in fish (Skaar 2001). Any impacts to mammals and birds would be indirect through short-term changes in food abundance (fish and aquatic insects). Extensive detail is provided within the EA it is encouraged to review the EA for further detail on this issue.

Issue 2. Why would the Yellowstone cutthroat trout currently residing within Soda Butte Creek with the low level of introgression be killed and replaced with a different source--why kill the slightly hybridized population?

Response: The proposed action in the draft EA would entail chemical removal of the existing fishery in Soda Butte drainage and after successful removal of all fish from Soda Butte Creek it would be restocked with native, nonhybridized Yellowstone cutthroat trout from the best available source. The proposed action of restocking with native, nonhybridized Yellowstone cutthroat trout from the best available source has been modified. Public comment, sensitivity to acceptable time required to reestablish Yellowstone cutthroat trout in Soda Butte Creek, and the lack of a solidified donor source(s) directed modification of the proposed action. The modification to the proposed action will entail using electrofishing gear to capture the slightly hybridized Yellowstone cutthroat trout (2013 genetic analysis of Soda Butte Creek 99.5% YCT, 2015 genetic analysis of unnamed tributary in Soda Butte Creek 99.6% YCT) prior to the chemical treatment. The fish will be held outside of the treatment area but within treatment drainage (either in tributaries that won't be treated or in hatchery tanks) and reintroduced following completion of the first treatment (also see Response to Issue 5).

Issue 3. Unique genetic traits (those that survived water quality issues) of Soda Butte Creek Yellowstone cutthroat trout would be lost with a complete fish removal and the source of nonhybridized Yellowstone cutthroat trout used to reestablish the fishery will not have these unique traits and may impact their ability to survive and thrive.

Response: The proposed action was modified to entail using electrofishing gear to capture the slightly hybridized Yellowstone cutthroat trout in Soda Butte Creek prior to the chemical treatment (See Response to Issue 2) and put salvaged fish back into Soda Butte Creek following the treatment. It is noteworthy that there is little detectable divergence amongst Yellowstone cutthroat trout populations in Montana and there have been multiple historic stocking events in the Soda Butte Creek with Yellowstone Cutthroat trout from outside the drainage. However the modification (fish salvage effort) would preserve the limited (if any) unique attributes of the Yellowstone cutthroat trout currently residing in Soda Butte Creek.

Issue 4. A concern that the Soda Butte Creek Conservation project is nothing more than moving forward with agenda of killing and restocking streams with 100% genetically pure fish and not so much about eradicating brook trout from Soda Butte Creek.

Response: Brook trout pose a threat to the Soda Butte Creek population and they are spreading downstream into YNP. Given the ability of brook trout to displace Yellowstone cutthroat trout, they are a risk to not only Soda Butte Creek, but the entire Lamar River watershed. It was publically presented and clearly articulated within the EA that eliminating brook trout threats in Soda Butte Creek, thereby eliminating threat of brook trout invasion into the Lamar drainage, is the primary objective of the project. By removing nonnative brook trout from the upper Soda Butte Creek watershed, project partners are working to ensure the long-term, self-sustaining persistence of Yellowstone cutthroat trout within its historic range. Removing brook trout would contribute to securing Yellowstone cutthroat trout throughout the Lamar River watershed, which is among the conservation objectives for Yellowstone cutthroat trout in Montana (note, Montana's Statewide Fisheries Management Plan, 2013 – 2018; the Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana, 2007; and the Yellowstone Cutthroat Trout Conservation Strategy for Montana, 2013). Furthermore, modification of the proposed action (see Response to Issue 2) to reestablish Soda Butte Creek with slightly hybridized Yellowstone cutthroat trout salvaged prior to the treatment refutes the assumption that agencies are moving forward with agenda of killing and restocking streams with 100% genetically pure fish and clearly illustrates that brook trout eradication to preserve Yellowstone cutthroat trout within its historic range was the primary objective.

Issue 5. Source and size of stocked fish, do transplanted fish relocate or do you anticipate they stay in the project area?

Response: Yellowstone cutthroat trout will be captured prior to the start of the project and placed back into Soda Butte Creek following the treatment (See Response to Issue 2). The fish that are salvaged will be of various sizes, as found in Soda Butte Creek. Supplemental stocking may occur years following the treatment with best available sources. Further investigation is required to solidify the best available source but preliminary genetic and health results suggest Pebble Creek and Antelope Creek (like Soda Butte Creek, both of these YCT populations are in the Lamar River drainage) as possible donor source candidates if supplemental stocking is required. It is noteworthy that multiple different strains of Yellowstone cutthroat trout have been stocked into Soda Butte thus may increase best available source candidates because the resident Yellowstone cutthroat trout have been influenced by those stockings. It is likely the fish salvaged prior to the treatment have a higher probability of staying in the project area than a fish of the similar size transplanted into the drainage. If supplemental stocking is executed it is probable that remote site incubators (used to rear and introduce eggs on site) will be utilized to increase the probability of the stocked fish remaining in the project area.

Issue 6. Clarification and detailed timetable of the project and reestablishment of Yellowstone cutthroat trout in Soda Butte Creek. How long until the fishery is re-established in Soda Butte Creek?

Response: The year of project implementation hinges upon timely releases of Final

Decision Notices by FWP and USFS. It is anticipated Final Decision Notices will be completed in a timely manner that allows the proposed action to proceed in 2015. If delays occur similar timing should be anticipated with a 2016 commencement year. The following timelines are estimated with a 2015 commencement year.

	Early August	Mid August	Late August	Early Septemeber	Mid Septemeber	Late September
Preliminary Data Collection for Project	X	X	X			
Collection of Yellowstone Cutthroat trout		X	X			
Rotenone Treatment		X	X	X	X	
Reintroduction of Salvaged fish					X	X

Results from treatment(s) and follow up sampling will dictate subsequent treatments (full or spot). Similar time of treatment should be anticipated. Electrofishing effort will be conducted pretreatment to collect Yellowstone cutthroat trout that will be placed back into Soda Butte Creek following the treatment. Reestablishment of the fishery similar to current estimated density can be very difficult to predict due to a multitude of variables; however, it is anticipated and intent was that salvaged fish may provide angling opportunity.

Issue 7. Utilize other removal efforts including electrofishing, angler harvest and do not allow harvest of Yellowstone cutthroat trout.

Response: As described in the EA, it is highly unlikely that these alternative methods would be effective at eradicating nonnative trout, due to stream size and habitat complexity in Soda Butte Creek. Extensive electrofishing brook trout removal efforts have been implemented in Soda Butte Creek since the early 1990s, and intensive electrofishing removal efforts have been conducted since 2004 but have been unsuccessful in eradicating brook trout. The size of Soda Butte Creek, and habitat complexity, are largely the reasons for unsuccessful electrofishing eradication of brook trout. The habitat conditions in Soda Butte Creek that impeded previous electrofishing efforts should not hinder rotenone efforts, and the eradication of brook trout would be expected with application of rotenone. A detailed comparison of chemical and mechanical removal can be found in the appendix of the EA. The document is title “White Paper: Removal of Fish using Chemical and Mechanical Means.” (also see Response to Issue 30). Using anglers to harvest brook trout does not achieve the projects objective of brook trout eradication. As suggested in the sampling data and anecdotal angler information, current brook trout densities are relatively low (attributed to the extensive intensive mechanical removal effort), which therefore makes eradication with angling impractical. Moreover, many fish are too small to be captured through angling, and these fish will persist to spawn in later years. The inaccessibility and difficulty of fishing in steep, remote tributary streams means these waters may remain as a continuous source of brook trout. Brook trout eradication through angling is not a viable approach. This view is supported by our electrofishing removal efforts that have not eradicated brook trout despite being a more efficient sampling method than angling. Furthermore, small fish are not vulnerable to angling, thus would remain in Soda Butte Creek. Not allowing harvest of Yellowstone cutthroat trout in Soda Butte also does not attain the objective of brook trout removal.

Issue 8. Brook trout numbers have been reduced with electrofishing, how is this not successful?

> ***Response:*** Mechanical removal has decreased brook trout abundance in some (not all) reaches; as evident within the EA (Table 1). However, it is important to note that eradication, not brook trout suppression, was the objective of the effort. Electrofishing removal has been conducted with intense effort since 2004, and the data show that while the population has been and remains suppressed (most reaches), it has not been eradicated. Therefore, electrofishing removal efforts have been unsuccessful at attaining the objective of full brook trout eradication. The EA presents the electrofishing data, a literature review of the general ineffectiveness of electrofishing in eradication of undesirable species, the invasive nature of brook trout, and their ability to displace native cutthroat trout. Based on a weight of evidence approach, the logical conclusion is that without eradication of brook trout from Soda Butte, brook trout will continue their invasion into Yellowstone National Park, thus threatening the Lamar Drainage (also see response to issue 30).

Issue 9. What stops the rotenone from going below the project area?

> ***Response:*** A detoxification station established immediately below the barrier at Ice Box Canyon would release potassium permanganate to the effective concentration of 2 to 5 ppm. This strong oxidizer rapidly breaks down rotenone into its nontoxic constituents, with total breakdown occurring within 15 to 30 minutes of exposure. Total breakdown typically occurs within ¼- to ½-miles of stream travel-time. A backup station would be established at ½ hour of the streams' travel time from the first station. The backup station would be operated only in the event of an equipment failure at the primary station.

Issue 10. What stops the fish (hybrids) or nonnative's from moving into the project area including "bucket biologist" (illegal fish introduction)?

> ***Response:*** In 2014, a bedrock chute in Ice Box Canyon on Soda Butte Creek was modified into a fish barrier to prevent upstream migration of hybrid and nonnative trout into the upper Soda Butte Creek watershed. Montana's fish transfer laws prevent law abiding individuals from introducing fish into Soda Butte Creek or any other of the state's rivers, creeks, or streams. Stopping illegal introductions can be very challenging and it is understood that illegal fish introductions are an inherent risk associated with this project, similar projects, and to native fish populations.

Issue 11. Need for long range effects of using rotenone.

> ***Response:*** (See Response to Issue 1) Rotenone is a commonly used piscicide, and FWP has a long history of using rotenone to manage fish populations, spanning as far back as the 1940s. A thorough literature review can be found in the EA. Additionally the

document titled “White Paper: Removal of Fish using Chemical and Mechanical Means” can be found in the appendix and provides review of the use of rotenone.

Issue 12. Re-consider definition of nonnative.

Response: Nonnative is defined as a plant or animal that is not indigenous to a particular place. Brook trout are not indigenous anywhere in the state of Montana or Wyoming therefore is considered a nonnative species.

Issue 13. Leave the rivers the way they are, against killing nonnative trout.

Response: Title 87-1-201 (9)(i) of the Montana Code Annotated directs Montana Fish, Wildlife and Parks to manage wildlife, fish, game and nongame animals [and sensitive species; section (9)(ii)] in a manner that prevents the need for listing under title 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq. Proposed work in Soda Butte Creek represents FWP carrying out duties as directed by the Montana State Legislature. Brook trout pose a threat to the Soda Butte Creek population and they are spreading downstream into YNP. Given the ability of brook trout to displace Yellowstone cutthroat trout, they are a risk to not only Soda Butte Creek, but the entire Lamar River watershed. Removing brook trout would contribute to securing Yellowstone cutthroat trout throughout the Lamar River watershed, which is among the conservation objectives in for Yellowstone cutthroat trout in Montana (note, Montana’s Statewide Fisheries Management Plan, 2013 – 2018; the Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana, 2007; and the Yellowstone Cutthroat Trout Conservation Strategy for Montana, 2013). Without such actions, the status of YCT in Montana will continue to decline, causing extirpation and potentially extinction; resulting in the loss of ecologically and culturally important native species. Lack of conservation efforts could lead to the listing of Yellowstone cutthroat trout under the Endangered Species Act and federal takeover of management of this species, possibly leading to more extreme mandated conservation efforts in the future.

Issue 14. Are you sure there are absolutely no undiscovered or rare species that would be impacted?

Response: Undiscovered by definition means not discovered thus its existence and subsequent impact would be unknown. Table 5 in the EA list species of concern, sensitive, and threatened with ranges overlapping the project area. The species of special concern, sensitive, and threatened species with the most potential to experience short-term disturbance in the area are: Columbia spotted frogs, western toads, Yellowstone cutthroat trout, harlequin ducks, lynx, and grizzly bears. Potential impacts are discussed in detail within the EA (pages 20-32).

Issue 15. Was the Goose Creek project successful?

Response: The purpose and need of the Goose Creek project was to replace the existing fisheries in Goose Creek, Huckleberry, Mutt and Jeff lakes with Yellowstone cutthroat trout in an effort to protect Goose Lake from brook trout colonization. The proposed action was to secure habitat for Yellowstone cutthroat trout in Goose Creek, free from the negative effects of competition, predation and displacement from brook trout, and aid in the long-term conservation of the species. The chemical removal project was completed by 2008. Subsequent gill net monitoring in Mutt, Jeff and Huckleberry Lakes have documented healthy Yellowstone cutthroat trout and no brook trout. The Goose Creek project attained the objectives and was successful.

Issue 16. Assumption that there was a previous project in Soda Butte Creek that removed all fish and there were no funds or intent to replace them.

Response: To date mechanical removal with electrofishing has been the only FWP fish removal project on the main stem (a small unnamed tributary was chemically treated in 2004) of Soda Butte Creek. Capture of fish using electrofishing is nonlethal and native YCT were released back into Soda Butte Creek, while brook trout were killed and removed from the stream. The objective was to eradicate brook trout. Yellowstone cutthroat trout were abundant at levels that did not warrant additional YCT stocking to replace brook trout that were removed. There was a chemical removal project on a small unnamed tributary (often referred to as Lulu Creek) that was conducted in 2004. Funds were available and this small tributary was stocked with 600 YCT on 8/1/2006, 1,500 YCT on 7/23/2007 and 500 YCT on 7/15/2008. It is noteworthy that historically McLaren Mill tailings created poor water quality that limited or prevented the fisheries within the upper reaches of Soda Butte but mitigation cleanup has improved water quality to levels now capable of sustaining fisheries.

Issue 17. The time of treatment; why was August selected as time of treatment?

Response: Late August was selected as the time for treatment for a number of reasons. Brook trout spawn in the fall and a treatment in late August would kill the brook trout prior to spawning. If a treatment were to occur after spawning, the eggs/embryos would not be subjected to a lethal dose of rotenone. Additionally the treatment must occur after the young fish emerge from the gravels to be subjected to a lethal dosage of rotenone. Also, late August average water discharge rates are more favorable than earlier in the year (lower discharge decreases habitat complexity; less back water, wetlands, springs etc). Although August is a busy time with visitors at Soda Butte Creek, spawning timing, susceptibility of life history stages, low stream flows, and the early onset of winter at this elevation resulted in late August being the selected time of treatment.

Issue 18. Budget request of past effort of electrofishing, treatment budget, and YCT reestablishment budget.

Response: The major FWP costs associated with proposed Soda Butte Creek project are related to personnel implementing the YCT salvage activities, and the chemical costs and labor resources necessary for the application of rotenone and $KMnO^4$. We estimate that it will require 90 to 160 man-days of FWP personnel to complete the YCT salvage and rotenone treatment over the anticipated two year project. The total per year cost of rotenone and $KMnO^4$ are estimated to be $6,601 to $10,289 (estimated assuming 10 drip stations below Silver Gate at 30 cfs and 28 drip stations upstream of Silver Gate at 15 cfs average and 72 hours operation at 5 ppm $KMnO^4$). The major FWP costs associated with prior electrofishing suppression are primarily related to personnel time, and are estimated to be 20 to 40 man-days each year over the last several years of this effort (also see Response to Issue 13).

Issue 19. What are current fish densities (fish/mile and total?)

Response: The most recent population estimates were conducted in 2013 in reaches between Sheep Creek and Silver Gate and the other reach that was estimated was between Road Bridge 1 and Road Bridge 2. At the time of 2013 survey, Sheep Creek to Silver Gate was estimated to host approximately 522 +/– 122 Yellowstone cutthroat trout within the 2.2 mile section. This would equate to an estimated 237 +/– 55 Yellowstone cutthroat trout/mile in the section. From Road Bridge 1 to Road Bridge 2 it was estimated to host approximately 1244 +/– 106 Yellowstone cutthroat trout within the 3.0 mile section. This would equate estimated 415 +/– 35 Yellowstone cutthroat trout/mile in this section.

Issue 20. How many milligrams of rotenone are in the average dead fish and at what level does it impact dogs?

Response: According to the EPA reregistration decision (2007) the total body residue is 1 ppb/g of fish. In general, ingested rotenone does not affect mammals because of digestive action in their stomach and intestines (AFS 2002). Investigations examining the potential for acute toxicity from ingesting rotenone find that mammals would need to consume impossibly high amounts of rotenone-treated water or rotenone-killed animals to obtain a lethal dose. For example, a 22-pound dog would have to drink nearly 8,000 gallons of treated water within 24 hours or eat 660,000 pounds of rotenone-killed fish within a day to receive a lethal dose (CDFG 1994) (see Response to Issue 1).

Issue 21. Why doesn't project extend for the entire Soda Butte Creek?

Response: The proposed project does not extend the entire length of Soda Butte because at this time brook trout have not been documented downstream of Ice Box Canyon barrier. The Ice Box Canyon barrier prevents nonnative fish from entering the project area following the treatment.

Issue 22. How to know when the project is being implemented and when to expect dead fish?

Response: Signs will be posted at trailheads and along the stream to warn people not to drink the water, consume dead fish, or have recreational contact with the water. According to the manufacture's label, signs must be posted warning humans not to enter the water during the time the signs are posted. For treatments applying less than 90 ppb rotenone (as proposed), the signs can be removed immediately after the treatment is complete. Dead fish should be anticipated at the onset of the treatment. As discussed in the EA, dead fish will be collected from the stream where practical, and disposed of offsite to reduce risk of attracting bears to the area.

Issue 23. Water quality issues may have created a benthic invertebrate population more resilient than the others from surrounding streams that are anticipated to repopulate Soda Butte Creek following the treatment.

> ***Response:*** Larval drift and reproduction by aerial adults are the primary mechanisms of recovery. Several miles of stream upstream of the treatment area provide a source of invertebrates drifting into reclaimed waters, and aerial adults usually disperse by laying their eggs upstream. Proximity to adjacent sub-watershed populations further expedites this recovery. Macroinvertebrates are in a diverse array of life history stages, and recently emerged adults are able to reproduce soon after treatment. Observations on Lower Deer Creek documented a substantial hatch of caddis flies and midges the day following treatment of an area (C.L. Endicott, FWP, personal communication). The well-established ability of macroinvertebrates to recover following disturbance, combined with the lower susceptibility of many taxa to rotenone, contributes to rapid recovery of invertebrate populations. Disturbance is a common occurrence in streams, and includes floods, wildfire, and human-caused alterations such as incompatible livestock grazing practices (Mihuc and Minshall 1995; Wohl and Carline 1996; Minshall 2003). It is noteworthy that much effort has been expended by other agencies and has been successful in improving water quality issues on Soda Butte Creek.

Issue 24. Removed and then limited availability of Yellowstone cutthroat trout for grizzly bear consumption.

> ***Response:*** Modification to the proposed action whereas Yellowstone cutthroat trout are captured before chemical treatment, and salvaged fish stocked back in Soda Butte Creek following the treatment, (see Response to Issue 2) substantially decreases the duration Soda Butte Creek Yellowstone cutthroat trout are not available for grizzly bear consumption. The modification to the proposed action results in a "fishless" condition in Soda Butte Creek in late August early September that is anticipated to last a few weeks while the original proposed action would have resulted in fishless state for 2 years. Also grizzly bears typically consume Yellowstone cutthroat trout during the peak of spawning, and the fishless condition will occur in August and September, well outside of the Yellowstone cutthroat trout spawning season. Additionally, grizzly bears are omnivores and very capable of adjusting to changes and temporary shortages of different food resources, thus there is no reason to believe that temporarily reducing the number of fish in Soda Butte Creek will impact the grizzly population.

Issue 25. What caused the change of mind and heart to eradicate all fish in Soda Butte Creek. Interpretation of 2011 Yellowstone Fisheries & Aquatic Sciences, Annual Report published by National Park Service. On page 21 states "These removal efforts (mechanical, electroshocking) are preventing an increase in the brook trout population of upper Soda Butte Creek and greatly reducing the potential for downstream dispersal of brook trout into the Lamar River and other tributaries. Comparison among years is difficult as effort has changed over the past four seasons. However, in the two sections sampled with equivalent effort in the park, brook trout catches declined significantly from 2010. Also, the low number of young-of-year fish (10) found in the sample area in 2011 is an encouraging sign that the removals are limiting spawning and recruitment"

> ***Response:*** Although FWP did not author the referenced 2011 Annual Report that states "….removal efforts (mechanical, electroshocking) are preventing an increase in the brook trout population of upper Soda Butte Creek and greatly reducing the potential for downstream dispersal of brook trout into the Lamar River…" it should be noted that while the population may be suppressed the threat of brook trout invasion has not eliminated within Soda Butte Creek. The objective of mechanical removal was to eradicate the threat of brook trout to Soda Butte Creek and eliminate the threat of brook trout invasion into the Lamar drainage (see Response to Issue 8). Without eradication, the threat of brook trout invasion into the Lamar drainage remains. Without complete removal of brook trout from Soda Butte Creek, downstream movement of brook trout is likely. Review of Table 1 within the EA contains updated brook trout removal results (also see Response to Issue 30).

Issue 26. How can you predict Yellowstone cutthroat trout will be impacted by brook trout?

> ***Response:*** The threat that brook trout pose to cutthroat trout was described in the EA and the citations provided in subsection introduction of the EA are just a few of the vast body of research addressing the role of brook trout in eliminating cutthroat trout populations. Brook trout are among the causes of decline of most subspecies of cutthroat trout, including the Rio Grande, Lahontan, westslope, Bonneville, Humboldt, Snake River fine-spotted, and Colorado River cutthroat trout. Fisheries agencies throughout the West are grappling with the same problem – preventing extirpation of cutthroat trout that are in sympatry with brook trout. In Montana, several case studies support the wealth of scientific literature on the propensity of brook trout to extirpate Yellowstone cutthroat trout. Smith Creek in the Shields River drainage in central Montana had a fishery where Yellowstone cutthroat trout were the most abundant species in the 1970s. By 2003, brook trout outnumbered Yellowstone cutthroat trout. Since the late 2000s few if any YCT have been found in Smith Creek during sampling efforts. The upper Shields River watershed provides an example of a current, rapid invasion of brook trout, potential extirpation of YCT. In the early 1970s, only YCT were present in South Fork Shields, Deep Creek, and Sunlight Creek. The most recent surveys have found abundant brook trout and no YCT. In addition, increasing numbers of brook trout have been observed in Bennett Creek, Crandall Creek, Dugout Creek, Turkey Creek, and Scofield Creek which are Yellowstone cutthroat trout habitat. Brook trout are replacing native cutthroat trout in Montana, and other western states. A potential cause results is that differences in spawning time, with brook trout being fall spawners, and YCT being spring spawners, results in size differences that brook trout young-of-the-year a competitive advantage over Yellowstone cutthroat trout young-of-the-year. Over time, this competitive advantage may allow brook trout to replace Yellowstone cutthroat.

Issue 27: Have you considered the impact to anglers and economic impact on local economy (Cooke City and Silver Gate)?

Response: The EA recognizes that this portion of Soda Butte Creek is highly popular with resident and visiting anglers, and fishing supports a considerable part of the economies of Silver Gate and Cooke City. Nonetheless, Soda Butte Creek downstream of Ice Box Canyon, and other neighboring streams in the Lamar River watershed would still provide high quality fishing opportunities if anglers are displaced by the project. The EA balances the short-term consequences of a relatively short period of a lack of angling upstream of Ice Box Canyon, with the long-term effects of losing the Yellowstone cutthroat trout in Soda Butte Creek and the Lamar River watershed due to invasion of brook trout (see Response to Issue 26). Although not all anglers, or U.S. citizens, value native fish, native species do enjoy the enthusiastic support of many park visitors and those interested in maintaining this component of the West's natural heritage. Yellowstone National Park is one of the few places where anglers can fish for native Yellowstone cutthroat trout, and many put great value on that opportunity. Moreover, the local communities value Yellowstone cutthroat trout as a source of revenue. Discerning anglers choose Silver Gate or Cooke City for their accommodations because of the proximity of cutthroat trout bearing streams. The number of shops selling Yellowstone cutthroat trout t-shirts supports this contention. Losing Yellowstone cutthroat trout in Soda Butte Creek, and ultimately the Lamar River watershed, to competition with brook trout, would provide an economic hardship to businesses in these towns, as many anglers may choose other locations for the pleasure of catching Yellowstone cutthroat trout. Furthermore modifications to the proposed action (see Response to Issue 2) whereas Yellowstone cutthroat would be salvaged to restore the population within Soda Butte Creek may expedite Yellowstone cutthroat trout recovery following the treatment.

Issue 28. Why undertake such a high risk endeavor with NO noticeable or usable reward?

Response: See Response to Issue1, Issue 13, and Issue 27. This collaborative effort includes Montana Fish, Wildlife & Parks (FWP), the Custer Gallatin National Forest (CGNF), the Shoshone National Forest (SNF), Wyoming Department of Game and Fish (WDGF), and the National Park Service (NPS), and focuses on eliminating the threats posed by nonnative species in Soda Butte Creek and the Lamar River drainage. All 4 agencies have conducted mechanical removal (electrofishing) of brook trout and despite multiple crews and 2 decades of effort, brook trout continue to persist in Soda Butte Creek. Brook trout are spreading downstream into Yellowstone National Park. The action would eliminate brook trout from Soda Butte Creek and prevent invasion of brook trout into the greater Lamar River watershed. Conservation of native fish brings a range of benefits to residents and visitors, and is required under state and federal law. Information provided in the EA describes potential risks of the proposed project on a diversity of aspects of the natural and human environments. A thorough review of the scientific data does not indicate that this is not a high risk endeavor. The effects of the project on this range of issues, if any, are short-term and minor. The reward for implementing this project is protection of a core population of Yellowstone cutthroat trout. These fish have intrinsic value as they are a part of the West's natural heritage, and popular among anglers. The result is noticeable and usable, given the popularity of fishing for native Yellowstone cutthroat trout. Moreover, failing to protect the remaining core populations of Yellowstone cutthroat trout increases the risk of listing under the Endangered Species Act

Issue 29. This issue was poorly noticed in a veiled attempt to silence opposition—a fact that is clearly evidence by the extremely low attendance at public meetings in Livingston and elsewhere this spring.

Response: Considerable effort was made to inform the public of the proposed project. Multiple press releases in regional newspaper from multiple agencies notifying the public of the proposed project. Additionally informative postcards were sent to over 60 landowners adjacent to Soda Butte Creek. Furthermore, four public meetings were held to engage and inform the public of the potential project. Two meetings were held prior to release of the EA to gauge public interest. One meeting was held in Silver Gate MT, on July 31, 2014. A second informational meeting was held in Billings MT on October 7, 2014. A public scoping meeting was held during the project's open comment period in Livingston MT on May 18, 2015. A second public scoping meeting during the project's open comment period was held in Cooke City on May 27, 2015. For additional exposure, the draft EA was posted on FWP's website beginning May 14, 2014 and through the duration of the public comment period.

Issue 30. Will the rotenone procedures be any better at removing trout than the electrofishing? Similar rotenone treatments at Cottonwood Creek, for example, failed to eliminate the brook trout even after 3 or more applications over a 4 year period.

Response: (See Response to Issue 7) As detailed in subsection 2.1, and the White Paper, "Removal of Fish using Chemical and Mechanical Means" in the appendices, in most situations, rotenone is more effective at removing fish than electrofishing, and is usually less costly. Mechanical removal through electrofishing is feasible in short reaches of small stream reaches with simple habitat, or in short reaches of small streams where fieldworkers remove streamside vegetation and woody debris with chain saws (Shepard et al. 2014). Vegetation and woody debris removal increases project costs considerably, and is not feasible in the upper Soda Butte Creek watershed, with 38 miles of channel slated for treatment, and an abundance of deadfall timber in tributaries and large woody debris jams on the main stem. Note that the removal of riparian vegetation and woody debris has short-term and long-term consequences on stream ecology, water temperature, habitat quality, and channel stability. The spatial extent of the project area, and the abundance of woody debris, makes mechanical removal infeasible in Soda Butte Creek. Subsection 2.1 also addresses how mechanical removal has failed to eradicate brook trout from Soda Butte despite 2 decades of concerted effort. Eradication effort has reduced brook trout density in some reaches (Table 1 in EA; Figure 5 in EA); however, a simple linear model of population trends of reaches 5 through 7, for the past 11 years of the removal effort (Figure 1) strongly indicates that mechanical removal would not eliminate brook trout from reaches in Yellowstone National Park, where they are relatively new invaders. Habitat complexity is considerable, with numerous debris jams providing refuge for brook trout. These regressions show no trend, a statistically insignificant decreasing trend, and a significant increasing trend during 11 years of removal. As mechanical removal cannot continue in perpetuity, these reaches would provide a continuous source of brook trout to invade streams in the Soda Butte Creek watershed and the Lamar River watershed.

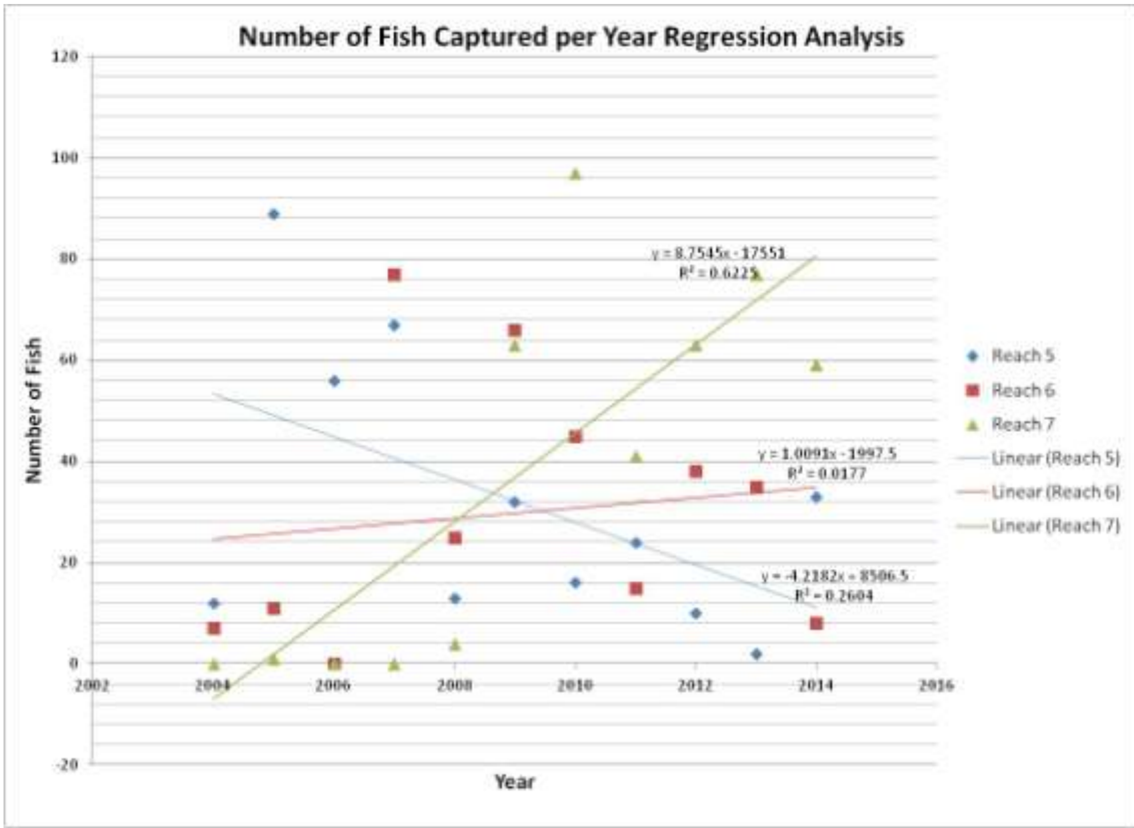

Figure 1. Linear models of populations trends over 11 years of removal efforts.

To summarize, the past 2 decades of electrofishing effort has failed to eradicate brook trout. Population growth and invasion into Yellowstone National Park, despite 2 decades of removal efforts, is alarming, and provides justification for abandoning mechanical removal of brook trout in favor of rotenone. To justify continued mechanical removal as a means to meet project objectives, the population trends in all reaches analyzed in Figure 1 would all need to meet the x-axis within a few years, and would need to have high considerably higher correlation coefficients to increase certainty that mechanical reclamation works. Brook trout are consummate invaders, and project success requires total removal of this nonnative species.

The Cottonwood Creek project that you mention is an outlier in terms of number treatments required, as usually 1 or 2 treatments are sufficient. As Cottonwood Creek has extensive beaver dam complexes, electrofishing would have effectively no chance of success. Nonetheless, beaver dam complexes present a challenge in using rotenone as well, given the need to maintain sufficient concentrations of rotenone in this intricate habitat. Although 4 treatments were necessary, Cottonwood Creek has been apparently free of brook trout since 2008, and supports a thriving population of native westslope cutthroat trout (Troy Humphrey, FWP, personal communication). Since the Cottonwood Creek project, FWP has refined treatment techniques and have better success in treating beaver dam complexes. For example, Sage Creek, a stream that originates in the Pryor Mountains, then flows into Wyoming, also had long expanses of beaver dam complexes. The first rotenone treatment effectively removed brook trout from most of the watershed, including the beaver influenced portions of stream. A few pockets of brook trout remained in tributaries, and these were removed with spot treatments of rotenone. This project restored Yellowstone cutthroat trout to 24 miles of historically occupied habitat.

In conclusion, rotenone is far more effective than electrofishing, except for rare situations. Short stream sections lacking complex habitat, or woody debris, can be candidates for mechanical removal. Electrofishing has been proven to be unsuccessful in Soda Butte Creek, resulting in the decision to use rotenone. Soda Butte Creek does not have beaver dam complexes, and the potential for full removal in 1 year is substantial, although a second treatment or discrete spot removals may be necessary. Meeting the project goal of full removal using electrofishing has a statistically minute probability of being successful, would take many decades, and would divert funds and personnel from other conservation projects. Meanwhile, brook trout would continue to invade streams in the Lamar River watershed, which puts the native Yellowstone cutthroat trout at substantial risk of eventual extirpation.

Issue 31. Insect damage in previous rotenone applications is not well documented.

Response: Please refer to subsection 3.4.1 of the EA (primarily on pages 26 and 27), which contains a literature review of the recovery of macroinvertebrate communities after rotenone.

Issue 32. Are there unintended consequences of the massive doses of permanganate, appears undocumented and lack of knowledge regarding Soda Butte water chemistry and geothermal activity where potassium permanganate will mix.

Response: Potassium permanganate is a strong oxidizer that is used to treat drinking water. Impacts of potassium permanganate on benthic macroinvertebrates, when applied as a deactivating agent during a rotenone treatment, are temporary, and similar to that of rotenone (Walker 2005). Potassium is the most toxic of the individual constituents, and would have an in-stream concentration of 1.23 ppm/L, when $KMnO^4$ is applied at 5 ppm, which is less than concentrations needed to reduce survival of aquatic organisms (Mount et al. 1997). Several factors affect the potential risks to aquatic life associated with the release of potassium permanganate, and the potential for reactions with reaches with upwellings of geothermal waters. The first entails break down and dilution of potassium permanganate as it travels downstream. Potassium permanganate breaks down in 1 hours travel time in streams. Without doing a dye test during low August flows, determining travel time is not possible; however, the extent of its degradation before it hits geothermally influenced waters will be considerable. Furthermore, 2 major tributaries enter Soda Butte Creek upstream of the geothermally active areas, which will dilute the potassium permanganate. In addition, although there is some geothermal influence in Soda Butte Creek, it is a very slight proportion of the overall surface water volume.

Combined, these factors suggest release of potassium permanganate will have no major interactions with geothermal waters.

Issue 33. Have you reviewed numerous studies (Bikash Raymahashay, 1968, Geochemica et Cosmochimica Acta, or various USGS papers by Robert O. Fournier, or Donald E. White) that looked at the tremendous variability of the water chemistry in active geothermal areas of Yellowstone? Why should I believe you are able to predict the chemical reactions that will occur when your permanganate cloud encounters pHs varying by 6 units (pH2 to pH8) over distances of 10s of meters. Do you think the permanganate damage to the EPT insects downstream will be less than the 99% EPT kill from the rotenone? How could you possibly know enough about the soda butte water chemistry, combined with the hydrodynamics of the turbulent flow around boulders and slumps in an active geothermal region, to justify assertions of no significant impact? Although the soda butte average pH is reported to be 8.1 and the average water temperature 2 C at the park boundary (Water Quality Assessment of the Yellowstone River Basin, 1999, Miller, Clark, and Wright), do you have data on the variation in pH and temperature in the geothermally perturbed stretches of the creek? Do you know how much 2C water will slow the decomposition of rotenone, or slow its reaction with the permanganate?

Response: With one exception, the citations you provided represent an enormous body of literature that address numerous topics in geology and hydrology, or were too vague to be useful. The study by Bikash Raymahashay (1968) addresses the Artist's Paint Pots, which is a cluster of numerous colorful hot springs, large mudpots, fumeroles, and active geysers. The level of geothermal activity dwarfs the small upwellings in Soda Butte Creek, and does not provide a relevant comparison. The reference to average water temperatures of 2℃ does not account for the fact that the project will be conducted in August, during the warmest time of year. Water temperatures substantially exceed 2℃ during this time, and will likely be in the range of 13℃ to 15℃. FWP and project partners have conducted numerous rotenone projects at similar elevations, often during the fall. The potassium permanganate was effective at the cooler fall temperatures, and will also be effective during August.

Issue 35. Electrofishing causes only local damage to unintended victims such as amphibians and invertebrates where a chemical treatment (where you may not know how the fate and transport is affected by the creek's water chemistry) seems like a poor trade-off. Has a systems analysis comparing the various means for killing fish been completed?

Response: The EA is essentially a systems analysis for rotenone as it provides a detailed analysis of the effects of rotenone on many components of the natural and human environments (see Section 3 Affect Environment and Predicted Environmental Consequences). The subsections with the most relevance to the issue are subsections 3.4.1 and 3.5.1. Subsection 3.4.1 provides information on the toxicity of rotenone to fish, macroinvertebrates, mammals, amphibians, and birds, and considers food web level effects. Subsection 3.5.1 addresses persistence, toxicity, and transport of rotenone, and toxicity of potassium permanganate. A thorough literature review results in the determination that rotenone treatment would have minor, short-term negative effects on aquatic organisms, fish, recreation, and local economies. The other alternatives would result in conditions that are detrimental over the long-term. Soda Butte Creek would continue to be a source of brook trout, and would have substantial negative effects on Yellowstone cutthroat trout in Soda Butte Creek and the Lamar River watershed. Brook trout can eliminate Yellowstone cutthroat trout from streams within years, unless humans intervene. Anglers seeking to fish for native Yellowstone cutthroat trout will not stay in Cooke City or Silver Gate. Losing the Yellowstone cutthroat trout population in the Lamar River watershed to competition with brook trout may provide justification for listing Yellowstone cutthroat trout for protection under the Endangered Species act, which will have negative economic effects on communities throughout the species' historic range, and federal taxpayers.

Regarding a systems analysis for mechanical removal, electrofishing is a well-studied method of capturing fish, and review of the literature considers the effects of electrofishing on fish and macroinvertebrates. Electrofishing does cause some injury to fish, although using the lowest setting possible, and the use of a smooth DC current, as opposed to a pulsed current, reduces injury (Dalbey et al. 1996). Re-shocking streams with tagged fish has found high survival, and no indications of long-term effect. Immediate injuries include electrical burns, bleeding gills, along with the stress of handling. The electrical current can also stuns macroinvertebrates and can kill fish eggs. Applying a systems analysis approach comparing electrofishing and rotenone indicates both result in death or injury of fish and macroinvertebrates, although rotenone is more lethal to these aquatic organisms. Neither affects food web dynamics over the long-term, given the ability of aquatic invertebrates to recover following disturbance, and the lack of toxicity from ingestion of rotenone treated water or killed fish. Accomplishing the intended purpose is where these techniques diverge. Except for in short stream reaches with simple habitat, mechanical removal does not accomplish the purpose of fish removal. In contrast, with rotenone, we have a proven track record of full fish removal from many streams and lakes, which is the purpose of the project. Impacts of potassium permanganate on benthic macroinvertebrates, when applied as a deactivating agent during a rotenone treatment, are temporary and similar to the effects of rotenone (Walker 2003). Mayflies are more sensitive to potassium permanganate than other taxa, but diversity returned to pre-treatment levels within 5 months. Like rotenone, application of potassium permanganate resulted in a temporary disruption to the food web dynamics.

Issue 36. Why does killing all the insects that the fish depend on – mayflies, caddisflies, and stoneflies – the EPT set of macroinvertebrates - have no consequences. Several reports have documented 99% destruction of EPT species subject to rotenone on Strawberry Creek, with substantially reduced populations of these crucial trout insects for 5 years after exposure (N.W. Darby etal, *Working Together to Ensure the Future of Wild Trout*, 2010). Baetis appear to be particularly devastated by the rotenone. (Oplinger and Wagner, Review of the effects of rotenone on aquatic invertebrates, 2011). Do you expect to repopulate your favored fish species, if they have no food source? The long term lack of insects appears to be a significant impact.

Response: The first component of the comment is incorrect. The EA does not state that rotenone treatment has no consequences for aquatic invertebrates. The EA acknowledges that an unknown proportion of macroinvertebrates, especially gill-respiring organisms, will suffer a lethal response, but that the effect will be short-term and minor owing to natural recolonization. Many taxa (usually species or genera) or life-history stages are not vulnerable to rotenone, and those organisms will not suffer a lethal effect. Subsection 3.4.1 of the EA considers the lethality, and long-term and short-term effects in detail. No studies document a long-term lack of invertebrates. The Strawberry Creek project in Utah (Mangum and Madrigal 1999), which provides a case study of the effects of rotenone treatment macroinvertebrates, and commenter assumed that populations remained reduced for 5 years. This is an incorrect interpretation; the paper does not address abundance of macroinvertebrates at all. The study attempted to evaluate the long-term effect of rotenone treatment on presence of individual taxa, not abundance. The prominent finding was that at most, 8 taxa of macroinvertebrate were “missing” from sampling stations 5 years following treatment. As streams can support hundreds of taxa, the “missing” taxa would likely comprise a tiny portion of the potential macroinvertebrate assemblage and would have no effect on the forage base, as considerable niche overlap occurs among taxa of macroinvertebrates, and other taxa would fill the supposed void. The Strawberry Creek study often emerges in discussions of the effects of rotenone on macroinvertebrates, so a brief critical review is warranted to evaluate its relevance to the current approach to piscicide treatment, and documenting the effects. Several factors limit the ability to generalize the findings of the Strawberry Creek study to current piscicide treatment practices. The duration of treatment and interval between treatments in Strawberry Creek were in dramatic excess of what we propose for Soda Butte Creek. The 150 ppb rotenone treatment ran for 48 hours, and was followed the next month with the same concentration, and duration of rotenone exposure. The Soda Butte Creek project proposes a treatment concentration of 25 to 50 ppb, with a bioassay being performed first to determine the lowest effective concentration. Drip stations run for 4 to 8 hours. Therefore, the Strawberry Creek project is not comparable to the Soda Butte Creek project in terms of rotenone concentration and duration of exposure. Sampling methodology presents a confounding factor in drawing inference among studies. Significantly, in the Strawberry River project (Mangum and Madrigal 1999), macroinvertebrates were sampled using Surber samplers, which collect invertebrates from a 1 to 1.5-ft^2 area at 3 discrete spots per station. Surber samplers were a preferred method of collecting aquatic macroinvertebrates until the mid-1990s, and this method remains useful in determining biomass or density of invertebrates. Nevertheless, it is a biased approach in evaluating community composition, and has long been abandoned for this purpose.

Current sampling methods to evaluate stream health entail the use of a kick net. The fieldworker stands upstream of the net, and vigorously kicks the substrate, allowing dislodged invertebrates to float into the net. The pattern of sampling a stream varies. This project will use the traveling kick net method, which entails moving from stream bank to stream bank in a zigzag pattern for a specified duration. Other methodologies collect invertebrates along 10 or more transects that run horizontally across the stream, from bank to bank. Both approaches sample considerably more area and microhabitats than Surber samplers, and collect a wider diversity of invertebrates. Streams provide diversity in habitat complexity and in the number of species that they support. Rarity of many taxa is common; however, the number of species within a reach can range from hundreds to thousands. Given the substantial potential for rarity, complexity of the habitat, patchiness in distribution, and seasonality of life history stages, no stream has had a census, or complete inventory, of all species present (Entrix 2010).

Natural among month, or among year, variability of species present is another consideration. Monthly sampling of the same location Logan River for 10 years provides a case study of community composition dynamics across time (Vinson et al. 2010). Little variability in numbers of species or genera occurred among sampling events; however, the presence of individual genera or species showed considerable variability. Over 60 genera had been collected at this site; however, the number of individual genera captured regularly was about 40% of the total number of genera found cumulatively. The list of genera continued to grow, with a new one appearing about every 2 months. The genera accumulation curve had been increasing steadily, and showed no sign of flattening out. Given the great natural variability of taxa present among samples, and the highly biased sampling method, Mangum and Madrigal's assumption that absence of a taxa from a sample meant that it was missing from the stream is unsupportable. The Logan River study shows that the great variability among samples limits inferences on taxa present. Moreover, proving absence is impossible.

The high, natural variability of macroinvertebrate presence, seasonality, vulnerability of different life-history stages to rotenone, sample methodology, sampling bias, and rarity of many taxa complicate drawing conclusions on the long-term effect of rotenone treatment on specific taxa. The factors most likely to the influence the response and recovery of aquatic invertebrate to piscicide treatments are: (1) concentration, duration, and spatial extent of the piscicide treatment; (2) invertebrate morphology and life history stage, including surface area to volume ratios, type of respiration organs, generation time, and propensity to disperse; (3) availability of refugia; and (4) distance from colonization sources (Vinson et al. 2010). The Strawberry Creek project used exceptionally high concentrations and duration of rotenone exposure, which is in direct conflict with the Vinson et al.'s recommendation to apply considerably lower concentrations for shorter durations as mitigative measures to reduce negative effects on macroinvertebrate communities.

The intrinsic value of macroinvertebrates, and their value in evaluating stream health, indicates these animals should be included in monitoring efforts associated with piscicide projects. As described in subsection 2.1.1 of the EA, macroinvertebrates will be collected at least 1 month before piscicide application at 3 locations within the project area, and at 1 location outside of the treatment area to serve as a control. Macroinvertebrates will also be collected on all streams flowing through wilderness. Note that the Strawberry Creek study did not include a control, which limits the ability to attribute the putative "missing" taxa to rotenone, rather than other environmental factors or natural variability. These sites will be re-sampled the following year to evaluate recovery.

Because taxa present show inherent variability over time and space, calculated metrics of biological integrity, other than an accounting of taxa present, provide a more robust means of determining the effects of rotenone on macroinvertebrates. For example, taxonomic richness, EPT richness, and abundance provide measures of evaluating the health of a stream following chemical treatment. Investigations in Montana found that immediately after application of CFT Legumine, mayflies and stone flies were reduced in richness and abundance; however, one year post-treatment, these taxa had returned to pretreatment levels of richness and abundance (Skorupski 2011). Montana DEQ has developed biological indicators of stream health that examine several metrics associated with stream health (DEQ 2012). Most other states and some federal agencies have developed similar tools. These assessments does not include analysis of taxa that have not been sampled since treatment, they employ a statistically based tool to determine if rotenone has had a negative effect on the health of a stream.

The finding that *Baetis* mayflies are especially vulnerable to rotenone is unsurprising given the relatively large surface area on the gills of nymphs. The EA acknowledges that gilled organisms are vulnerable to rotenone in subsection 3.4.1. Leptophlebiid mayflies are perhaps even more susceptible considering the extreme feathering of their gills. The absence of *Baetis* from the lists of species not yet recovered (Mangum and Madrigal 1999), suggests this common, widespread and diverse genus has resiliency to withstand disturbance. Indeed, *Baetis* are often multivoltine, meaning they have more than one life cycle per year. This quality makes *Baetis* among the first colonizers following disturbance (Cook and Moore 1969; Wallace and Gurtz 1986). Their susceptibility to rotenone does not result in lasting negative effects on *Baetis* mayflies. In fact, they have a short-term competitive advantage, given their ability to recolonize disturbed areas rapidly. Early invaders also have reduced competitors and predators following treatment. As stated in subsection 3.4.1, early colonizers experience an explosive resurgence in the weeks following rotenone treatment (Cook and Moore 1969).

For detailed information on the issue that rotenone will eliminate the forage base for fish, please read the discussion of the cycle of disturbance, recolonization, and recovery of aquatic invertebrates detailed in subsection 3.4.1 of the EA. To reiterate, streams are disturbance-driven systems, and macroinvertebrates evolved to handle these events. Taxa poorly adapted to disturbance would go extinct. Macroinvertebrates recolonize disturbed areas through downstream drift of larvae or nymphs. Indeed, fly fishing with nymphs would not be a sport if invertebrates did not drift as a dispersal mechanism. Aerial adults fly upstream to lay eggs, providing another mechanism of recolonization. Aerial adults also invade from neighboring watersheds.

Experience in Lower Deer Creek, a stream east of Big Timber, Montana illustrates that sufficient numbers of invertebrates can survive rotenone treatment to support a reestablished fishery. FWP and project partners applied rotenone in late summer of 2010. Before treatment, we salvaged as many Yellowstone cutthroat trout as possible, and about 800 fish were returned to Lower Deer Creek the day after treatment ceased. Formal monitoring of the fishery began in 2014 (Endicott 2015). Starting at the downstream extent of the project reach, fieldworkers electrofished upstream for 5 miles in a single pass. They captured 2,805 Yellowstone cutthroat trout, and no brown trout – the species targeted for removal. Over 1,500 Yellowstone cutthroat trout, mostly age-1 fish, were captured in 1.5 miles of Placer Gulch, a small stream that is an important spawning tributary for Yellowstone cutthroat trout. The obviously high survival, despite release immediately after rotenone treatment, substantial growth, and explosive reproduction indicate that sufficient numbers of aquatic invertebrates survived or recolonized to support the Yellowstone cutthroat trout released immediately post-treatment.

The last issue that there will be a long-term lack of invertebrates is incorrect. In section 3.4.1 of the EA, a thorough review of the research on the response aquatic invertebrates to rotenone treatment shows that although there is an immediate reduction in taxa richness and biomass, recolonization begins within 2 weeks. Taxa richness and biomass of invertebrates recovers within a year. An abundance of macroinvertebrates will be available to support fish when they are returned to Soda Butte Creek.

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